

NON-PUBLIC?: N
ACCESSION #: 8712290045
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Point Beach Nuclear Plant PAGE: 1 of 5

DOCKET NUMBER: 05000266

TITLE: Reactor Trip with Safety Injection Due to Spray Valve Failure
EVENT DATE: 11/21/87 LER #: 87-005-00 REPORT DATE: 12/15/87

OPERATING MODE: NA POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: C. W. Fay - Vice President Nuclear Power TELEPHONE #: 414-221-2811

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: AB MANUFACTURER: F180 REPORTABLE TO NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On November 21, 1987, at 0305 hours, Unit 1 reactor coolant pressure began decreasing and the reactor tripped due to low pressurizer pressure. Reactor coolant pressure continued to decrease until safety injection initiated flow to the reactor coolant system. Pressure was lost when a pressurizer spray valve stuck open. An unusual event was declared at approximately 0331 hours and was terminated at 0457 hours.

An inspection of the pressurizer pressure control equipment revealed two failures, a broken solder joint in a pressurizer spray valve controller and a stuck pilot valve in the associated pressurizer spray valve positioner resulted in the spray valve being maintained in the full open position. The minimum pressure reached while the spray valve was stuck open was 1378 psig. The maximum pressure reached after the pressurizer was filled with water was approximately 2077 psig.

The controller and pilot stem were repaired and returned to service. The unit was then returned to full power operation.

(End of Abstract)

EVENT DESCRIPTION

The Unit 1 reactor had been operating at or near 100 percent since its last refueling/maintenance outage ending in May of 1987. On November 21, 1987, at approximately 0305 hours, the control room received a "Pressurizer Low Pressure" alarm. Almost two minutes later, after primary pressure reached the rate-compensated low pressure setpoint, the reactor tripped. As pressure continued to decrease, a safety injection signal was generated. The pressure decline continued until safety injection began to flow into the reactor coolant system. 1700 gallons of approximately 11 percent boric acid was injected from the boric acid storage tank and 2750 gallons of approximately 2000 ppm boric acid was injected from the refueling water storage tank.

It was determined that the spray valve PC-431B had stuck open and caused the sudden pressure decrease. An investigation determined the cause of the open pressurizer spray valve was two-fold. First, a solder joint in the spray valve controller was broken, and second, the air pilot valve for the spray valve positioner stuck in the open position. These two failures caused the spray valve to open quickly and stick in the full open position despite the fail close design. In this condition, there was no way for the operators to close the spray valve positioner from the control room. The pressurizer spray valve controller and positioner were repaired, tested and returned to service at 0946 hours. The reactor was again critical at 1916 hours.

An unusual event was declared at 0331 hours because water was injected into the reactor coolant system as a result of the safety injection. The unusual event was terminated at 0457 hours when the plant was stable and personnel had verified there were no other complicating factors.

PLANT AND SYSTEM RESPONSES

As discussed in the description, a reactor trip occurred when the pressurizer pressure reached the rate-compensated trip setpoint of two out of four pressure channels reaching 1810 psig. The trip actually took place at approximately 1828 psig due to the rate compensation/anticipation built into the sensing and control circuitry.

After the trip, the pressure continued to decrease and safety injection initiated when the setpoint of 1735 psig was reached. Water injection into the reactor coolant system occurred when the pressure in the reactor coolant system reached 1483 psig which is

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below the shutoff head of the safety injection pumps. Injection continued for approximately 22 minutes until the pressurizer was filled with water. This resulted in a total of 4450 gallons of borated water being introduced into the reactor coolant system. Once the pressurizer was filled, reactor coolant pressure was restored to normal using emergency operating procedures. The minimum pressure reached while the spray valve was stuck open was 1378 psig and the maximum pressure reached after the pressurizer was filled was 2077 psig. Normal operating pressure is 1985 psig.

SYSTEM DESCRIPTIONS

Spray Valve Controller

The spray valve controller 1PC-431H (Model No. 62H-2E-0 (SPEC)) was manufactured by Foxboro. This controller modulates the spray valve 1PCV-431B in response to the compensated pressure input signal (10-50 ma) from the master pressure controller. The controller modulates the position of 1PCV-431B such that during steady-state operation, the valve begins to open at 2010 psig and is fully open at 2060 psig. The controller output is a current signal (10-50 ma) which is transmitted to a current to pneumatic (I/P) transducer. This transducer outputs a 3-15 psig air signal proportional to the 10-50 ma current input signal. This air signal is transmitted to the valve positioner. It is possible to take manual control of the spray valve controller and adjust the controller output to whatever is desired by the operator.

Spray Valve Pneumatic Positioner

The spray valve is a modulating valve operated by a Bailey pneumatic positioner. The positioner input is the 3-15 psig air signal from the I/P transducer. It outputs air pressure to the valve operating diaphragm which counteracts the valve closing spring. With 3 psig supplied to the valve positioner, the positioner output pressure supplied to the valve operating diaphragm is 0 psig and the valve is closed. As input air pressure increases above 3 psig, the air pressure supplied to the valve operating diaphragm increases proportionately and the valve opens until the desired position as

sensed by a position feedback force balance mechanism is reached. The valve will remain at that position until the positioner senses a change in the input air signal. The Energy Industry Identification System component function identifier for the controller and positioner are not available. The system identification for the pressurizer is AB.

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GENERIC IMPLICATIONS

No generic implications have been identified in this incident.

REPORTABILITY

This Licensee Event Report is provided pursuant to 10 CFR 50.73(a)(2)(iv), "Any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)."

CAUSE

The reason the spray valve stuck open appears to have been caused by a combination of failures. When the spray valve controller is working normally, an input current signal (10-50 ma) which corresponds to steady-state reactor coolant pressure results in a proportional output current signal (10-50 ma) being sent to the spray valve positioner. The broken solder joint resulted in an output signal which was not proportional to the input signal and of a step change in magnitude being sent to the spray valve positioner. When the valve positioner received the step change in input signal, it responded by opening the spray valve. As this occurred, the positioner pilot valve stem stuck in the full open position maintaining the spray valve full open regardless of the controller output signal.

The cause of the broken solder joint has been attributed to vibration and work hardening of the solder joint. Visual inspection of the positioner revealed no reason for its behavior. It was easily freed up and the valve operated normally; however, the pilot valve did stick again. The pilot valve and associated orifices were therefore replaced and tested to verify the new components do not stick. The stuck pilot stem did make it impossible to close the spray valve upon command from the control room.

SAFETY ASSESSMENT

The failure of the pressurizer spray valve in the full open position did not compromise the health or safety of the plant employees or the public. Engineered safety systems at Point Beach Nuclear Plant performed as designed to return the plant to a safe shutdown condition.

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CORRECTIVE ACTIONS

The immediate corrective actions were to repair the broken solder connection and replace the pilot valve stem and associated orifices. Subsequent testing of the valve operation verified proper operation. It should be noted that both the spray valve controller and spray valve positioner are tested during each refueling outage.

SIMILAR OCCURRENCES

There have been no previous safety injections at Point Beach initiated by an open spray valve.

ATTACHMENT # 1 TO ANO # 8712290045 PAGE: 1 of 1

Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P. O. BOX 2046, MILWAUKEE, WI 53201 (414)277-2345

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December 17, 1987

U. S. NUCLEAR REGULATORY COMMISSION
Document Control Desk
Washington, D. C. 20555

Gentlemen:

DOCKET 50-266
LICENSEE EVENT REPORT 87-005-00
REACTOR TRIP WITH SI DUE TO SPRAY VALVE FAILURE
POINT BEACH NUCLEAR PLANT, UNIT 1

Attached is Licensee Event Report 87-005-00 for Point Beach Nuclear Plant, Unit 1, detailing a reactor trip with safety injection (SI) flow to the reactor coolant system as a result of

a failure in the control equipment for the pressurizer spray valve. This LER is filed pursuant to 10 CFR 50.73(a)(2)(iv), "Any operation or condition that resulted in manual or automatic actuation of any engineered safety feature (ESF), including the reactor protection system (RPS)."

If any further information is required, please contact us.

Very truly yours,
/s/ C. W. Fay
C. W. Fay
Vice President
Nuclear Power

Enclosure

Copies to NRC Resident Inspector
NRC Regional Administrator, Region III

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